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MENTAL ABILITY TESTING IN THE SELECTION OF AIR FORCE OFFICERS: A BRIEF HISTORICAL OVERVIEW

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This paper addresses the use of officer selection and classification tests from the early 1940s to 1986, with emphasis on the evolution of the Air Force Officer Qualifying Test (AFOQT). It is intended as a readable historical overview of officer testing, not as a detailed technical document. The paper emphasizes AFOQT test forms and content as they relate to each other, up to and including the present operational version, Form O.

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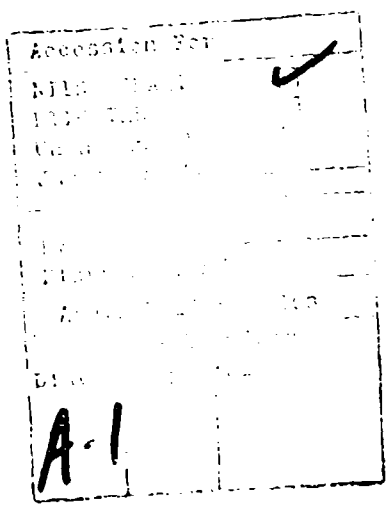
SUMMARY

This paper traces the development of aircrew and officer selection and classification tests in the United States Air Force from the early 1940s to 1986. Early selection procedures are briefly described, along with test developments leading up to early forms of the Air Force Officer Qualifying Test (AFOQT). Discussions of test forms and content are included for AFOQT-64 through AFOQT Form O, along with norming references.



PREFACE

This work was completed under Task 7719l8, Selection and Classification Technologies, which is part of a larger effort in Force Acquisition and Distribution. It was subsumed under Work Unit 77191819, "Development and Validation of Selection Methodologies." This work unit was established in response to Air Force Regulation (AFR) 35-8. The authors thank Dr. Lonnie Valentine, Dr. Malcolm Ree, Dr. William Alley, Mr. Douglas Cowan, and Ms. Jacobina Skinner for their constructive comments on this paper, Ms. Nancy Perrigo for her thorough editing, as well as Ms. Sandy Stringfellow and Mr. Gene Ligon for their support with text, tables, and figures.

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MENTAL ABILITY TESTING IN THE SELECTION OF AIR FORCE OFFICERS: A BRIEF HISTORICAL OVERVIEW

I. INTRODUCTION

The United States Air Force has two separate systems for personnel selection and classification. The enlisted selection system is concerned with obtaining high school graduates and selected non-graduates for technical training and subsequent assignment in areas such as electronics and aircraft maintenance. The officer selection system is concerned with obtaining college graduates for managerial, professional, and specialized (e.g., pilot and navigator) jobs.

Currently there are three major sources of commissioned officers for the Air Force. First is the United States Air Force Academy (USAFA) at Colorado Springs, Colorado. This source involves acceptance of Congressionally recommended high school graduates into a 4-year college program followed by commissioning upon graduation. The Air Force incurs full financial responsibility for all USAFA cadets. Therefore, the USAFA route is the most expensive and time-consuming precommissioning alternative. Enrollment is limited, and the number of new officers commissioned through this program can be predicted with a relatively high degree of accuracy.

The second source of commissioning is through the Air Force Reserve Officer Training Corps (AFROTC). AFROTC detachments are maintained at several hundred university and college campuses throughout the United States. The actual precommissioning program requires enrollment in the Professional Officer Course (POC) conducted during the last 2 years of college. There are 2- and 4-year AFROTC scholarships available which provide the Air Force with one way of acquiring individuals with special skills, such as in engineering and computer science. AFROTC provides a relatively stable annual output at a cost per commissioned officer that is far less than that of the USAFA.

The third major source of commissioning is the Officer Training School (OTS) conducted at Lackland AFB, Texas. Applicants for OTS must have completed an approved college program prior to entry. The OTS program requires about 3 months of instruction covering the same general topics as are found in the general military curriculum at the USAFA or the POC courses at the AFROTC detachments. OTS is the most flexible precommissioning program with respect to the number of new officers commissioned. Enrollment expands and contracts to fill the officer manpower needs of the Air Force not met by USAFA and AFROTC. This program is the least expensive and most rapid means of obtaining officers.

The Air Force officer recruitment process is guided by the type and quantity of officer job vacancies existing at any particular time. For example, the nationwide recruiting goal for October 19XX may be 85 pilots, 40 navigators, 20 missile launch officers, etc. An individual can apply for a specific job only when a vacancy for that job exists. Assuming a job opening is available, the applicant must go through the sequential selection process illustrated in Figure 1. Each decision point has its own specific criteria. For example, educational requirements may specify completion of certain courses (e.g., calculus) or a certain specific degree program (e.g., electrical engineering, finance, computer science). Also, cumulative grade point average (GPA) and the particular school attended may be considered. Physical requirements may include 20/20 vision or some minimum age limitation. Moral requirements specify that applicants must be of sound moral character (AFR 53-27, p. 5) and may prohibit entry to anyone arrested and/or convicted for such things as involvement with narcotics or dangerous drugs.

One of the major decision points in the initial selection process considers mental qualifications. An instrument used in the selection sequence is a multiple aptitude test battery called the Air Force Officer Qualifying Test (AFOQT). The current AFOQT (Form O) is composed of

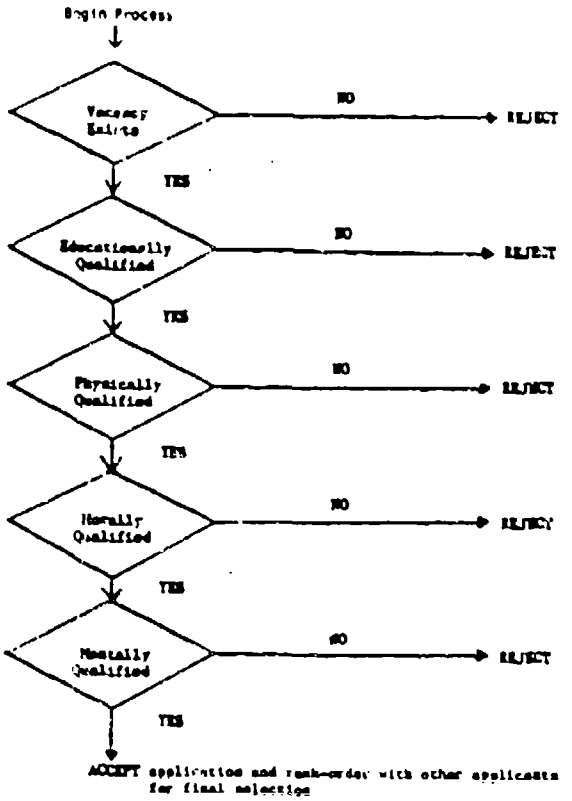

Figure 1. Basic Sequential Selection Strategy for Air Force Officer Applicants.

16 subtests combined to yield five composite scores: Pilot, Navigator-Technical, Academic Aptitude, Verbal, and Quantitative. The composites and the subtests which compose them are detailed in Table 1. The Academic Aptitude composite, previously called the Officer Quality composite, is obtained by combining the Verbal and Quantitative composites. This composite is roughly analogous to sections of the Scholastic Aptitude Test (SAT) or the Graduate Record Examination (GRE). The Pilot composite is used for classification into Undergraduate Pilot Training (UPT), and the Navigator-Technical composite is used for classification into Undergraduate Navigator Training (UNT). If an individual meets or exceeds minimum qualifying scores on the AFOQT composites, a formal application is forwarded to be considered for selection into OTS or AFROTC.

Although the present precommissioning programs are indirectly linked to obtaining an academic degree, the selection of candidates for precommissioning training originated out of efforts to obtain qualified students for training as military aviators. Selection of officer candidates is a dynamic process that has undergone many changes. A chronological review of Air Force officer selection will demonstrate the reasons for these changes and the resulting impact.

Table 1. Construction of AFOQT Form O Composites

AFOQT subtests	AFOQT composites				
	Pilot	Navigator-technical	Academic aptitude	Verbal	Quantitative
Verbal Analogies	X		X	X	
Arithmetic Reasoning		X	X		X
Reading Comprehension			X	X	
Data Interpretation		X	X		X
Word Knowledge			X	X	
Math Knowledge		X	X		X
Mechanical Comprehension	X	X			
Electrical Maze	X	X			
Scale Reading	X	X			
Instrument Comprehension	X				
Block Counting	X	X			
Table Reading	X	X			
Aviation Information	X				
Rotated Blocks		X			
General Science		X			

II. AVIATION PSYCHOLOGY PROGRAM

Beginning in 1920, the educational requirement for entrance into Army aviation training was high school graduation or its equivalent. Because of increasing numbers of applicants for aviation training, the educational requirement was increased to 2 years of college, or its equivalent, in 1927 (Guilford & Lacey, 1947).

Prior to World War II, qualification for pilot training was based on age, educational qualification, and a thorough medical examination, which only about 20% of the applicants could pass. Since the demand for pilots was less than 300 per year, the large number of medical eliminations was not a major concern. Most of the pilot selection work was done by the flight surgeons at the Army Air Corps[1] School of Aviation Medicine (DuBois, 1947). Several early attempts at selecting student pilots through use of physiological and psychological testing met with only limited success (Ericksen, 1952).

As world tension mounted, the pilot training program continued to accelerate and new advances were being made in predicting pilot success. This led the Medical Division to recommend the activation of a Psychological Research Agency to develop and validate new instruments for selecting pilots. On 14 June 1941, General C.H. Brett, Chief of the Air Corps, approved the recommendation.

In order to staff the Aviation Psychology Program, the first of four Psychological Research Units was activated at Maxwell Field, Alabama (Flanagan, 1948). The personnel recruited and commissioned to work at the research centers were psychologists, measurement specialists, and technicians from throughout the country. Most held prominent positions at the time of their

[1] In 1941, the Air Corps was joined with the Air Force Combat Command and other air units, which comprised the Army Air Forces. In 1942, the functions, duties, and powers of the Chief of the Air Corps were transferred to the Commanding General, Army Air Forces (AAF).

commissioning in the early 1940s. Some of these individuals included: John C. Flanagan, Associate Director of the Cooperative Test Service of the American Council on Education; Robert L. Thorndike, Associate Professor of Education, Teachers College, Columbia University; J.P. Guilford, Professor of Psychology, University of Southern California; Frederick B. Davis, Consultant, American Council on Education, Washington, DC; Laurance F. Shaffer, Professor of Psychology, Carnegie Institute of Technology; and Neal E. Miller, Research Associate, Yale University. Support personnel designated to work in the research centers were brought in from the officer and enlisted ranks of the Air Corps to complete the formation of the Aviation Psychology Program.

Selection of cadets for aircrew training was redesigned as a three-stage screening process. Acceptance for training required that an applicant (a) be physically qualified, (b) possess a minimum level of academic ability, as evidenced by at least 2 years of college, and (c) demonstrate potential as an aircrew member. Because of the large number of aircrew personnel needed and the shortage of physically qualified college students in 1941, one of the first tasks of the Aviation Psychology Program was development of a general abilities test to replace the college requirement (Flanagan, 1948).

With the bombing of Pearl Harbor in 1941, the requirements for aircrew personnel increased dramatically. There was difficulty in meeting the demand. The need for new procedures for selection and classification of aircrew personnel - pilot, navigator, and bombardier - had become critical.

III. INITIAL SELECTION

The new general intelligence test was a 150-item screening examination known as the Aviation Cadet Qualifying Examination (ACQE). The first test was approved by General H.H. Arnold, Chief of the Air Corps, on 14 January 1942. The test was administered to over a million men during the war years. The ACQE "was used for the preliminary selection of only the commissioned officers and flight officers in the aircrew - pilots, bombardiers, and navigators" (Davis, 1947, p. 1). On 1 June 1944, the title of the screening test was changed to the Army Air Forces Qualifying Examination (AAFQE) since it was also to be used for selecting enlisted men who would serve as gunners. The terms ACQE and AAFQE refer to the same basic test; both acronyms are used interchangeably in much of the literature.

The use of an initial screening test continued for several years. The purpose of the screening test was determination of the likelihood of success in flying training of young men with less than 2 years of college education or its equivalent. Replacement of the educational requirement with a test of general abilities allowed the applicant pool to be greatly expanded to include young men from the farms and factories as well as the universities. During their use, one-quarter to one-half of all applicants were rejected because of low scores on the screening tests (Flanagan, 1948).

The new tests could partially demonstrate a candidate's capability to complete training, but it was also necessary to develop a special examination to screen and classify potential aircrew members. Thus, development of an aircrew classification battery was another major task of the Aviation Psychology Program.

IV. AIRCREW CLASSIFICATION BATTERY

Table 2 contains a chronological summary of officer selection tests from 1942 through 1955, when the AFOQT came into standard usage in lieu of the Aircrew Classification Battery, up to

1981, when the current form of the AFOQT was implemented. Dubois (1947) provides a very detailed discussion of classification tests used during the war. All information in this section, except discussion of the college training program, was obtained from that report.

Table 2. Chronological Summary of Air Force Officer Selection Tests (1942 - 1981)

Year	Initial Screening Tests	Selection and Classification Tests
1942	Aviation Cadet Qualifying Examination (ACQE)	Aircrew Classification Battery (ACB)
1944	Army Air Forces Qualifying Examination (AAFQE)	
1947	Air Force Qualifying Examination (AFQE)	Post-War ACB Discontinued
1949	Aviation-Cadet Officer-Candidate Qualifying Test (AC-OC-QT)	
1950	Aviation Cadet Qualifying Test (ACQT)	
1951	Air Force Officer Qualifying Test (AFOQT) Preliminary Version	ACB Reinstated
1953	AFOQT Form A	
1954	AFOQT Form B	
1955		Psychomotor Testing Discontinued
1956	AFOQT Form C	
1957	AFOQT Form D	
1958	AFOQT Form E	
1959	AFOQT Form F	
1960	AFOQT Form G	
1964	AFOQT-64	
1966	AFOQT-66	
1968	AFOQT-68	
1970	AFOQT Form K	
1972	AFOQT Form L	
1975	AFOQT Form M	
1978	AFOQT Form N	
1981	AFOQT Form O	

The Aircrew Classification Battery (ACB) was first introduced in February 1942. The composition of the battery, consisting of paper-and-pencil tests as well as psychomotor tests, was dictated by the availability of current tests. Both speeded and power tests were included and a stanine scoring system was used for reporting results, though no one was eliminated on the basis of stanines at this time.

During the next 3 years, there were many revisions to the ACB (see Table 3). Based on experience and suggestions from field units, the highly speeded, perceptual subtests having short time limits were eliminated with the April 1942 revision. By August 1942, the ACB was used for selection as well as classification. The July 1943 revision included subtest and scoring changes, and the Officer Quality composite (now called the Academic Aptitude composite) was included for the first time. The November 1943 version of the ACB was the first to be used by the newly established Medical and Psychological Examining Units. These units accepted applicants for aircrew training based on the results of the psychological examination, but classification occurred during preflight training.

Table 3. Characteristics and Milestones of Selected Versions of the Aircrew Classification Battery (ACB)

ACB version	Key features/milestones
February 1942	First battery had three stanines:[a] Pilot, Navigator, and Bombardier
April 1942	Highly speeded perceptual subtests eliminated
June 1942	Longer time limits and revised weighting system
August 1942	Used for selection as well as classification
December 1942	Universal use of psychomotor tests and introduction of career preference scales
July 1943	Officer Quality Score included for first time
November 1943	First version used by Medical and Psychological Examining Units
September 1944	Expanded to seven stanines: Bombardier, Navigator, Bomber Pilot, Fighter Pilot, Aerial Gunner, Air Mechanic-Gunner, Radio Operator-Gunner
June 1945	Last revision during wartime Three gunnery stanines replaced by single Aerial Gunner stanine
April 1951	Reinstated at six field testing stations
March 1952	Verbal and Quantitative stanines derived
February 1954	Final battery became operational
July 1955	AFOQT used for aircrew selection

[a] In the original source, the term "stanine" apparently refers to what is now called a "composite" score.

The ACB of September 1944 had some marked changes, the most notable being the addition of more composites. It was decided that separate classifications should be made for bomber and fighter pilots, as the training and aptitudes for these specialties differed. The original three composites - Pilot, Navigator, and Bombardier - were expanded to seven. They were Bombardier, Navigator, Bomber Pilot, Fighter Pilot, Aerial Gunner, Air Mechanic-Gunner, and Radio Operator-Gunner. The ACB of June 1945 was the last revision during wartime. The major change which occurred in this version of the battery was the replacement of the three gunnery composites with a single Aerial Gunner composite.

In 1943, a college training program began which made provisions for retesting. Those individuals who were not accepted for aircrew training due to psychological aptitude deficiencies were retested after being sent through a basic center for military and college training. This

was a 1- to 5-month program that was available on 153 college campuses. It was thought that instruction in mathematics, physics, current history, geography, and English would help to eliminate the educational deficiencies of the 100,000 civilians accepted into aircrew training but for whom training facilities were not available (Flanagan, 1943). Also allowed to retest were those men tested before 4 July 1942 and men who had returned from combat.

V. POSTWAR EXPERIMENTATION

The characteristic feature of officer selection research and development after World War II was experimentation. This experimentation included not only new test batteries and composites, but changes in the manner of test administration, the normative base used, and the prerequisites for applicants. The period of experimentation lasted from about 1947 to 1955.

The subtests and composites of the 1 June 1945 ACB remained in effect after the end of World War II. Dailey and Gragg (1949) described the test changes that occurred immediately after the war. There were no pilot training classes for approximately 6 weeks after V-J Day (15 August 1945); classes were resumed in October of 1945. Only student officers were tested at this time. Testing eventually spread to West Point cadets and to civilians, including AFROTC students. Finally, traveling caravans were used for administration of both paper-and-pencil and psychomotor tests, with the psychomotor apparatus transported in trailers. In October 1947, the ACB was discontinued because applicant flow decreased to the point where all were accepted who could pass the Air Force Qualifying Examination (AFQE) and had the required 2 years of college or its equivalent.

During the period of experimental testing, the battery underwent some structural changes. Initially, norming was based on a sample of the wartime population that had been given the June 1945 version of the ACB (Davis, 1947). By April 1947, however, it was decided that the battery needed to be normed on a sample of a postwar population. As a result, new conversion tables were developed from a sample of 500 West Point cadets. The revisions remained in effect until the April 1951 ACB (Dailey, 1951).

In the interim between the 1947 ACB and 1951 ACB, an experimental test, the Aviation-Cadet Office -Candidate Qualifying Test (AC-OC-QT, Forms AXA and AXB), was designed. It had three purposes: (a) to screen applicants for Officer Candidate School (OCS, now called Officer Training School) and for direct commissioning; (b) to screen aviation cadet applicants for aviation training aptitude; and (c) to ensure that aviation cadet applicants possessed those non-flying aptitudes needed for completion of non-flying training such as electronics courses (Tupes, 1953).

In October 1950, the two AC-OC-QT booklets were republished for operational use as the Aviation Cadet Qualifying Test (ACQT). The ACQT was used to predict success on the 1947 version of the ACB and was correlated with the 1951 ACB. It was decided, based on results of the correlations, that the ACQT would be used to predict success on the April 1951 ACB as well (Zachert & Hill, 1952). Thus, the ACQT replaced the ACQE as a screening device.

In March 1951, Headquarters Air Training Command requested that the ACB be reinstated as a selection device for aircrew personnel. The ACB became operational again in April 1951 (Dailey, 1951). Also at the time of the request for reinstatement, six field testing stations were authorized to be set up at various Air Force bases throughout the United States. Applicants not near a test site were sent to one of the stations to complete the battery. Each testing site was capable of administering both paper-and-pencil and psychomotor portions of the test. The 2-day administration of the test was divided: paper-and-pencil on the first day, and psychomotor on the second day (Zachert & Ivens, 1952).

As the Air Force continued to expand in size, it was becoming increasingly difficult to recruit the required number of aviation cadets with 2 years of college. So, in February 1952, this requirement was again eliminated. Verbal and Quantitative composite cutoffs on the March 1952 ACB were implemented to increase the probability of selecting aviation cadets whose "officer quality" would be adequate for performance of other duties in addition to flying (Folsom, 1952a; 1952b). An Officer Quality composite became operational immediately; it was used as a screening device to substitute for the 2-year college education requirement. The last aircrew battery, dated November 1953, became operational for aircrew selection in February 1954, and continued until July 1955, at which time psychomotor testing was discontinued,[2] and aircrew selection was based on the recently developed Air Force Officer Qualifying Test (AFOQT) (Valentine & Creager, 1961).

VI. AIR FORCE OFFICER QUALIFYING TEST

The preliminary version of the AFOQT was designed in 1951 and incorporated the AC-OC-QT. The AFOQT was designed to predict success in OCS as well as screen for aircrew training. The first form, Form A, evolved from this preliminary version. Form A was a compilation of the USAF Officer Activity Inventory, the Attitude Survey developed in 1952 (Berkeley & Yourick, 1952), and the 1951 preliminary AFOQT. The instrument contained five composites: Officer Quality, Observer-Technical, Pilot, Verbal, and Quantitative.

Form A was administered to AFROTC Air Science II cadets in the spring of 1953. It was administered experimentally to Air Science III and IV cadets in the fall of 1953. It was then used as a selection device for advanced AFROTC training until September 1955, when Form B, designated the Officer Selection Form, was implemented. The AFOQT replaced the ACB for aircrew selection and was used to screen applicants for OCS and AFROTC until fall, 1956 (Tupes, 1955; Tupes & Christal, 1957; Valentine & Creager, 1961).

Valentine and Creager document the flow of AFOQT Forms C through E:

> Beginning with AFOQT, Form C, a three-year usage cycle across officer procurement programs (including Air Reserve and Air National Guard) was introduced. Each new form of the battery was used in selecting one Air Force Academy class, and then implemented operationally in other officer procurement programs (excluding Air Reserve and Air National Guard). One year later the form was released for use in the Air Reserve and Air National Guard programs. A new form of the battery was produced each year. This usage cycle continued without interruption through Form E which, in 1959, was put into use in the Air Force's new Officer Training School program as well (1961, p. 4).

Form F was used from November 1958 through April 1959 for selection of USAFA cadets. It was implemented in the other programs in September 1959, and remained operational in those programs for 2 years. Form F also marked the implementation of an additional conversion table, a separate Officer Quality composite for females, and a change in composite name from Observer-Technical to Navigator-Technical (Valentine & Creager, 1961).

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[2]This change ended the heavy reliance on psychomotor tests, which had previously marked officer selection and classification testing.

Form G, used from November 1959 to April 1960, was the last form of the AFOQT administered for selection purposes at the USAFA (Miller, 1960). The AFOQT had been one of several selection criteria used to evaluate applicants for admission to the Academy. College Entrance Examination Board (CEEB) tests were also used. Administration of both the CEEB tests and the AFOQT was considered too time-consuming, especially in light of similarity of results. Therefore, it was decided that the AFOQT could be eliminated from the USAFA selection criteria without altering selection efficiency. The CEEB tests were retained because of their use in civilian colleges (Miller, 1960).

During the operational use of Forms C through G, "the most accurate statement of the meaning of recent AFOQT norms would be that they compare the examinee with performance of applicants for the first few USAFA classes" (Valentine & Creager, 1961). Form G remained operational until September 1963, when AFOQT-64 was implemented. (See Table A-1 in the Appendix for test content information.) The 1964 version of the AFOQT brought with it many changes. In addition to format changes (subtests, items, etc.), a new normative base was devised which used the male 12th grade population of the United States. This was done by relating the AFOQT to the Project TALENT battery, a battery used to survey about 400,000 students in a stratified sample of secondary schools (Miller & Valentine, 1964).

The project TALENT battery was administered to approximately 3,300 basic airmen, stratified by Air Force Qualification Test (AFQT; now called Armed Forces Qualification Test) deciles in the centile range of 21 to 100. The AFQT is a test of general ability, stemming from the 1940s. Scores for the AFQT, AFOQT Form G, and the Airman Qualifying Examination (AQE) were obtained for each airman in the sample, a yield of about 2,500 complete cases. Appropriate combinations of TALENT battery variables were determined to predict each of 27 Air Force variables through multiple regression analysis. The scores of the 27 Air Force variables were equated to the corresponding TALENT composite by means of an equipercentile equating procedure. From this, estimates of TALENT percentiles were computed on a subsample of 12th grade males in the TALENT sample for each TALENT composite (Dailey, Shaycoft, & Orr, 1962). AFOQT-64 was then normed against the 27 variables in a similar manner, as detailed by Miller and Valentine (1964, pp. 6-7).

With one exception, AFOQT-66, the next version, had content areas identical to the AFOQT-64. (See Table A-2 in the Appendix for test content information.) The one exception was the replacement of Flight Orientation with a subtest called Stick and Rudder Orientation (Miller, 1966). This subtest contained photographs of terrain as it would appear from an aircraft executing a maneuver. The response consisted of indicating the appropriate control stick and rudder bar manipulation. Standardization of the instrument was again done by reference to the Project TALENT battery, allowing scores to be related to the performance of USAFA candidates and 12th grade males (Miller, 1966).

The next version, AFOQT-68, was identical to the AFOQT-66 in content areas and organization (Miller, 1968b; see Table A-3 in the Appendix for test content information). The standardization procedures used were different, however. AFOQT-68 had two sets of normative data. The TALENT normative base was still used, but, in addition, junior (company grade) officers were tested in the verbal and quantitative areas with a separate instrument, the Defense Officer Record Examination (DORE). The results of the DORE were then essentially used as control variables, allowing AFOQT scores for AFROTC and OTS samples to be equated in terms of actual level of aptitude. From this, two conversion tables, one for AFROTC and one for OTS, were designed (Miller, 1968a). The differences between the conversion tables were based on educational effects, which were thought to be different for the two commissioning sources; AFROTC tested early in college and OTS tested after graduation.

The number of conversion tables was expanded when it was decided that those applying for the Airman Education Commissioning Program (AECP) and the Bootstrap Commissioning Program (BCP) could

not be evaluated on the same tables as those for the OTS applicants. AFROTC maintained their own conversion tables because the educational level of AFROTC examinees was lower than that of OTS applicants, who were college graduates. Thus, a separate conversion table was then created for AECP and BCP (Miller, 1969), making a total of three such tables.

AFOQT Form K brought no significant structural changes. (See Table A-4 in the Appendix for test content information.) It differed from AFOQT-68 in that three sets of conversion tables were used, each based on educational level (Miller, 1970). The first set was for those examinees who had not completed 2 years of college at the time of testing and corresponded to the AFROTC tables of the AFOQT-68. The second set of tables was used for those examinees who had completed more than 2 years of college but who were not graduates, and was derived from the newly developed AECP and BCP conversions. The third set, the OTS tables, was used for those examinees who had successfully graduated from a college program. These tables were based on studies which indicated that formal education probably has an elevating effect on AFOQT scores (Gregg, 1968; Tupes & Miller, 1969).

AFOQT Form L, implemented in 1972, was like Form K in construction and standardization. (See Table A-5 in the Appendix for test content information.) The difference between these two forms was in the scoring technique. A new machine-scannable answer sheet was used which could be scored by hand, by machine, or by computer. Two sheets printed on both sides were provided with Form L (Miller, 1972). Form L was standardized on the Project TALENT group, yielding three sets of conversion tables based on the education level of the examinee at the time of testing.

AFOQT Form M, implemented in 1975, brought only one change. It consisted of the same composites and norms as its predecessors (see Table A-6 in the Appendix for test content information), but it introduced a separate conversion table for the Pilot composite to be used only with female applicants. Thus, Form M had 21 separate conversion tables, five composites for each of the three educational levels, plus female-specific tables for Officer Quality and Pilot scores. As with previous versions of the AFOQT, Miller (1974) showed how the standardization of Form M was indirectly related to the USAFA candidate group by use of "equipercentile conversions from AFOQT Form G, which was administered to USAFA candidates, through composites of tests from the Project TALENT battery to the new form of the AFOQT" (p. 7).

A validation study performed by Valentine (1977) indicated the need for a revision to the AFOQT. The revision was incorporated into Form N. Form N, implemented in 1979, brought not only structural changes (see Table A-7 in the Appendix for test content information), but changes in norming as well. Its basic structure was still along the line of recent AFOQT forms, although Form N increased the number of subtests and items, which resulted in adding a third machine-scorable answer sheet.

The normative base used for Form N was obtained from a research sample designed to represent the full range of test ability (i.e., the "ideal" range of ability expected in the officer applicant population). The sample included subjects from the three precommissioning sources, as well as active duty second lieutenants to form the top end of the ability range. To provide performance data on the lower portion of the ability range, airmen in Basic Military Training were used. Figure 2 illustrates the proportional representation of these subjects by source. The subjects were pooled into a single group and then put into three separate subgroups based on educational level: less than 2 years of college, more than 2 years of college but not graduates, and college graduates. Distribution of performance by the subgroups served as the basis for development of the new conversion tables (Gould, 1978).

There have also been some changes associated with Form O, the form currently in use. First, this instrument, implemented in 1981 (see Table A-8 in the Appendix for test content information), is the first form of the AFOQT to be equated to an anchor test (Form N) by use of the common items used in both versions of the AFOQT.

Second, there was some indication that educational differences may not have been as pronounced as previously thought (see, for example, Gould, 1978). Therefore, the number of conversion tables for Form O was reduced to five (one for each composite), in an attempt to provide simpler, more meaningful comparisons between and within groups. Further research is necessary to clarify this issue.

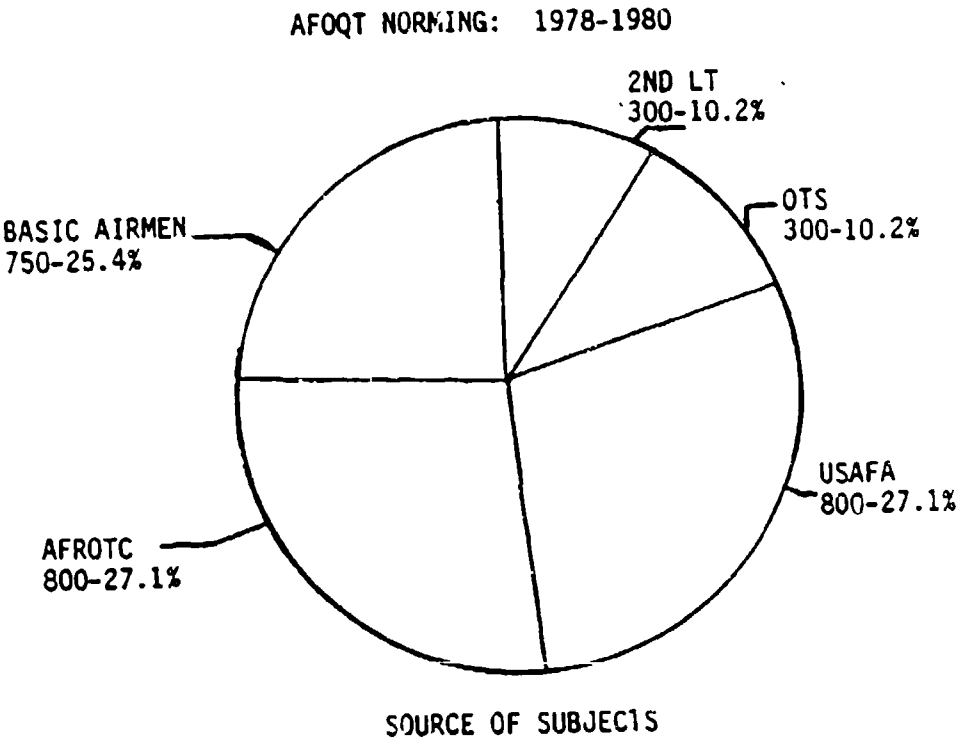

Figure 2. Composition of Normative Base Used for AFOQT Form N.

Finally, there have been administrative changes associated with Form O. Every test answer sheet is now electronically scanned and computer-scored at one of two central locations: Maxwell AFB for all AFROTC detachments and Brooks AFB for all other test sites. By using an automated scoring and processing procedure, most of the administrative and technical problems associated with a large-scale testing program (35,000 to 40,000 examinees tested at over 500 test sites worldwide each year) have been eliminated.

VII. RECENT DEVELOPMENT

During the first three decades of operational use, the AFOQT used four different normative bases: West Point cadets, USAFA cadets, an indirect link to USAFA using Project TALENT, and an experimentally designed, representative sample of the "ideal" applicant population. Each form of the test battery was standardized on some identifiable reference group. A method was developed in 1980 which placed three successive forms (L, M, and N) of the AFOQT on a common measurement scale (Roach & Rogers, 1982).

In each new form of the AFOQT, there is always a certain proportion of items obtained from the previous version. These items are known as "anchor items" and are used to provide continuity between successive forms. Through the use of anchor items and the method of equipercentile equating (Angoff, 1971), it was possible to equate Form M to Form N. Thus, two successive forms of the AFOQT were linked to the same normative base and to each other. The most immediate advantage of this procedure has been the development of a very large database which has improved AFOQT research and development.

Forty years of research in the Air Force have resulted in an efficient and effective officer selection and classification process. The examinations and procedures used in this process are continually being validated and improved whenever possible, with the end goal of providing the best possible officer selection and classification tools to the Air Force.

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APPENDIX A: CONTENT OF AFOQT 1964 THROUGH AFOQT FORM O (1981)

Table A-1. Content of AFOQT-64 (1964)

Subtest[a]	Items	Composites				
		P	V-T	OQ	V	Q
Booklet 1 (PRT 922)						
Quantitative Aptitude	60		X	X		X
Booklet 2 (PRT 923)						
Verbal Aptitude	50			X	X	
Officer Biographical Inventory[b]	100			X		
Booklet 3 (PRT 924)						
Scale Reading[c]	48		X			
Aerial Landmarks[c]	40		X			
General Science	24		X			
Booklet 4 (PRT 925)						
Mechanical Information	24	X	X			
Mechanical Principles	24	X	X			
Booklet 5 (PRT 926)						
Pilot Biographical Inventory	50	X				
Aviation Information	24	X				
Visualization of Maneuvers[c]	24	X				
Instrument Comprehension[c]	24	X				
Flight Orientation[c]	40	X				
Total	542					

[a]Associated administrative and scoring manuals are PRT 920 and 921, respectively. Associated answer sheets are PRT 87, 927, and 928. Special manuals and answer forms are used in the AFROTC program. Scale Reading, Aerial Landmarks, and Flight Orientation are scored R-W/4; Visualization of Maneuvers and Instrument Comprehension are scored R-W/3. Other subtests are scored as number right only.

[b]Not administered to female applicants.

[c]Speeded subtests.

Table A-2. Content of AFOQT-66 (1966)

Subtest[a]	Items	Composites				
		P	M-T	OQ	V	Q
Booklet 1 (AFPT 932)						
Quantitative Aptitude	60		X	X		X
Booklet 2 (AFPT 933)						
Verbal Aptitude	60			X	X	
Officer Biographical Inventory[b]	100			X		
Booklet 3 (AFPT 934)						
Scale Reading[c]	48		X			
Aerial Landmarks[c]	40		X			
General Science	24		X			
Booklet 4 (AFPT 935)						
Mechanical Information	24	X	X			
Mechanical Principles	24	X	X			
Booklet 5 (AFPT 936)						
Pilot Biographical Inventory	50	X				
Aviation Information	24	X				
Visualization of Maneuvers[c]	24	X				
Instrument Comprehension[c]	24	X				
Stick and Rudder Orientation[c]	24	X				
Total	526					

[a]Associated administrative and scoring manuals are AFPT 930 and 931, respectively. Associated answer sheets are PRT 87, AFPT 937, and AFPT 938. Special manuals and answer forms are used in the AFROTC program. Scale Reading and Aerial Landmarks are scored R-W/4; Visualization of Maneuvers and Instrument Comprehension are scored R-W/3. Other subtests are scored as number right only.

[b]Not administered to female applicants.

[c]Speeded subtests.

Table A-3. Content of AFOQT-68 (1968)

Subtest[a]	Items	Composites				
		P	N-T	OQ	V	Q
Booklet 1 (AFPT 941)						
Quantitative Aptitude	60		X	X		X
Booklet 2 (AFPT 942)						
Verbal Aptitude	60			X	X	
Officer Biographical Inventory[b]	100			X		
Booklet 3 (AFPT 943)						
Scale Reading[c]	48		X			
Aerial Landmarks[c]	40		X			
General Science	24		X			
Booklet 4 (AFPT 944)						
Mechanical Information	24	X	X			
Mechanical Principles	24	X	X			
Booklet 5 (AFPT 945)						
Pilot Biographical Inventory	50	X				
Aviation Information	24	X				
Visualization of Maneuvers[c]	24	X				
Instrument Comprehension[c]	24	X				
Stick and Rudder Orientation[c]	24	X				
Total	526					

[a]Associated administrative and scoring manuals are AFPT 939 and 940, respectively. Associated answer sheets are PRT 87, AFPT 946, and AFPT 947. Special manuals and answer forms are used in the AFROTC program. Scale Reading and Aerial Landmarks are scored R-W/4; Visualization of Maneuvers and Instrument Comprehension are scored R-W/3. Other subtests are scored as number right only.

[b]Not administered to female applicants.

[c]Speeded subtests.

Table A-4. Content of AFOQT, Form K (1970)

Subtest[a]	Items	Composites				
		P	M-T	OQ	V	Q
Booklet 1 (AFPT 951)						
Quantitative Aptitude	60		X	X		X
Booklet 2 (AFPT 952)						
Verbal Aptitude	60			X	X	
Officer Biographical Inventory[b]	100			X		
Booklet 3 (AFPT 953)						
Scale Reading[c]	48		X			
Aerial Landmarks[c]	40		X			
General Science	24		X			
Booklet 4 (AFPT 954)						
Mechanical Information	24	X	X			
Mechanical Principles	24	X	X			
Booklet 5 (APFT 955)						
Pilot Biographical Inventory	50	X				
Aviation Information	24	X				
Visualization of Maneuvers[c]	24	X				
Instrument Comprehension[c]	24	X				
Stick and Rudder Orientation[c]	24	X				
Total	526					

[a]Associated administrative and scoring manuals are AFPT 949 and 950, respectively. Associated answer sheets are PRT 87, AFPT 956, and AFPT 957. Special manuals and answer forms are used in the AFROTC program. Scale Reading and Aerial Landmarks are scored R-W/4; Visualization of Maneuvers and Instrument Comprehension are scored R-W/3. Other subtests are scored as number right only.

[b]Not administered to female applicants.

[c]Speeded subtests.

Table A-5. Content of AFCQT, Form L (1972)

Subtest[a]	Items	Composites				
		P	M-T	OQ	V	Q
Booklet 1 (AFPT 962)						
Quantitative Aptitude	60		X	X		X
Booklet 2 (AFPT 963)						
Verbal Aptitude	50			X	X	
Officer Biographical Inventory[b]	98			X		
Booklet 3 (AFPT 964)						
Scale Reading[c]	48		X			
Aerial Landmarks[c]	40		X			
General Science	24		X			
Booklet 4 (AFPT 965)						
Mechanical Information	24	X	X			
Mechanical Principles	24	X	X			
Booklet 5 (AFPT 976)						
Pilot Biographical Inventory	50	X				
Aviation Information	24	X				
Visualization of Maneuvers[c]	24	X				
Instrument Comprehension[c]	24	X				
Stick and Rudder Orientation[c]	24	X				
Total	524					

[a]Associated administrative and scoring manuals are AFPT 960 and 961, respectively. Associated answer sheets are AFPT 967 and AFPT 968. Special manuals and answer forms are used in the AFROTC program. Scale Reading and Aerial Landmarks are scored R-H/4; Visualization of Maneuvers and Instrument Comprehension are scored R-W/3. Other subtests are scored as number right only.

[b]Not administered to female applicants.

[c]Speeded subtests.

Table A-6. Content of AFOQT, Form M (1975)

Subtest[a]	Items	Composites				
		P	M-T	OQ	V	Q
Booklet 1 (AFPT 972)						
Quantitative Aptitude	60		X	X		X
Booklet 2 (AFPT 973)						
Verbal Aptitude	60			X	X	
Officer Biographical Inventory[b]	96			X		
Booklet 3 (AFPT 974)						
Scale Reading[c]	48		X			
Aerial Landmarks[c]	40		X			
General Science	24		X			
Booklet 4 (AFPT 975)						
Mechanical Information	24	X	X			
Mechanical Principles	24	X	X			
Booklet 5 (AFPT 976)						
Pilot Biographical Inventory	50	X				
Aviation Information	24	X				
Visualization of Maneuvers[c]	24	X				
Instrument Comprehension[c]	24	X				
Stick and Rudder Orientation[c]	24	X				
Total	522					

[a]Associated administrative and scoring manuals are AFPT 970 and 971, respectively. Associated answer sheets are AFPT 967 and AFPT 968. Special manuals and answer forms are used in the AFROTC program. Scale Reading and Aerial Landmarks are scored R-W/4; Visualization of Maneuvers and Instrument Comprehension are scored R-W/3. Other subtests are scored as number right only.

[b]Not administered to female applicants.

[c]Speeded subtests.

Table A-7. Content of AFOQT, Form N (1978)

Subtest[a]	Items	Composites				
		P	M-T	OQ	V	Q
Booklet 1[b] (AFPT 982)						
Arithmetic Reasoning	25		X	X		X
Math Knowledge	25		X	X		X
Data Interpretation	25		X	X		X
Booklet 2[b] (AFPT 983)						
Word Knowledge	25			X	X	
Reading Comprehension	25			X	X	
Background for Current Events	25			X	X	
Verbal Analogies	25	X		X	X	
Booklet 3 (AFPT 984)						
Table Reading[c]	50	X	X			
Electrical Maze[c]	30	X	X			
Block Counting[c]	80	X	X			
Scale Reading[c]	48	X	X			
Tools	25	X	X			
Mechanical Comprehension	24	X	X			
Booklet 4 (AFPT 985)						
Rotated Blocks	20		X			
Aerial Landmarks[c]	40		X			
General Science	24		X			
Instrument Comprehension[c]	24	X				
Pilot Biographic and Attitude Scale	66	X				
Total	606					

[a]Associated administrative and scoring manuals are AFPT 980 and 981, respectively. Associated answer sheets are AFPT 987-989. Special answer forms (AFPT 990-992) are used in the AFROTC program. Instrument Comprehension is scored R-W/3, and remaining speeded subtests are scored R-W/4. Other subtests are scored as number right only.

[b]Booklets 1 and 2 use the same answer form.

[c]Speeded subtests.

Table A-8. Content of AFOQT, Form O (1981)

Subtest[a]	Items	Composites				
		P	N-T	AA	V	Q
Verbal Analogies	25	X		X	X	
Arithmetic Reasoning	25		X	X		X
Reading Comprehension	25			X	X	
Data Interpretation	25		X	X		X
Word Knowledge	25			X	X	
Math Knowledge	25		X	X		X
Mechanical Comprehension	25	X	X			
Electrical Maze	20	X	X			
Scale Reading	40	X	X			
Instrument Comprehension	20	X				
Block Counting	20	X	X			
Table Reading	40	X	X			
Aviation Information	20	X				
Rotated Blocks	15		X			
General Science	20		X			
Hidden Figures	15		X			
Total	380					

[a]All subtests are contained in a single test booklet, AFPT 982. Associated administrative manual is AFPT 980. The answer sheets used are AFROTC PTF 987 (ROTC only) and AFPT 987 (all others). All subtests are scored as number right only. No subtests are specifically designated as speeded since all subtests contain elements of both power and speed.